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Android Based Oscilloscope Using Android Mobile

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Abstract:

This paper presents the proposed design and implementation of a light-weight, low power, portable, low-cost, singlechannel oscilloscope consisting of a hardware device and a software application. The device is embedded with a Bluetooth module to provide connectivity to a device.An oscilloscope, known as a scope, CRO or DSO is a type of electronic test instrument using which we can observe constantly time varying signal voltages, usually as a 2-D graph in which we can represent electrical voltages using the vertical axis plotted against time. Oscilloscopes nowadays we use today are CRO or DSO which is little bit difficult to use as well as not portable and consumes more power. The Wireless Oscilloscope android application helps one to observe the waveform of the closed circuit. This application is supported by all Smartphone's and tablet computers (Receiver's) that work on Android operating system. Hence it is easy portable and easy installation. At the end of the closed circuit, BluetoothModule is used to transmit the waveform signal over radio frequency and then is received by receiver using Bluetooth. At last Graphical Waveform is reproduced in receiver.

Keywords — **Android O.S, Bluetooth Module, AVR ATMega16 Controller ,LCD**

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1. INTRODUCTION

Portable oscilloscopes currently in the market are very expensive, less power efficient and have small low resolution displays. This paper presents the design and implementation of a low cost, portable, light-weight; low power,single channel oscilloscope consisting of a hardware device and a software application. The device is equipped with a Bluetooth module to provide connectivity to a device with Bluetooth, running the Android operating system (OS), in order to display the waveforms. Android OS is selected because there are a decent number of Android device users and most of these devices satisfy the requirements of the oscilloscope's software application. The Software application developed for Android receives the data transmitted from the hardware device and plots the waveform according to the display settings configured by the user. [1] By using mode switch we can select the measured parameter.

This Measurement System is also known as Mini-Oscilloscope which present some Cathode Ray Oscilloscope features that help in the measurement of Triangular wave and Square wave, Sine wave, Resistance Value. The External Bluetooth module operational with the microcontroller will transport the input signal to an Android Device's, running on the Android operating system. Using external Bluetooth gadget and display of Android Device, the system becomes more useable and convenient.In this Measurement system we used HC-05 Bluetooth module, AVRATmega16 Microcontroller and Android application with Android Smartphone for this whole application.[5]

1.1Project objective:

1. To design a system to measure the signals and display it wirelessly on an Android OS based phone as well as LCD Display.
2. To design a low cost and effective measuring device.
3. To make a handy and user-friendly application, this can be effectively used by students and researchers. The Inputs given will be processed by an embedded system and will be transmitted via a wireless communication protocol (in our case Bluetooth Module). A java based application will be developed on the Android OS platform which will accept this incoming data and visualize the same.

2. Literature Survey:

In the modern world, cathode-Ray oscilloscope plays a major role in electronic measurement field. CRO is mainly used to measure the voltage across the circuit with change in time. The major disadvantage of CRO is to spend huge amount of money to buy it .To overcome this problem we use" Android Oscilloscope" by using AndroidMobile. Today's CROs maximum DC voltage range is 80 volt (Peak to peak).We can measure both AC and Dc voltage by using this Android App Maximum AC voltage range up to 230volt andDC voltage measure from 0 to 5v.CROs frequency range is 20MHz and in the Android Oscilloscope frequency rangeup to 1KHz and we will try to calculate more than 1KHz.We can measure resistance by applying voltage divider rule.

3. System Overview

Handy oscilloscope is most important application in this mobile generation. We can easily move from one place to another place. This handy oscilloscope require small circuit to manage input and provide to android Bluetooth sensor. The Wireless Oscilloscope android application helps to observe the waveform of the closed Circuit.

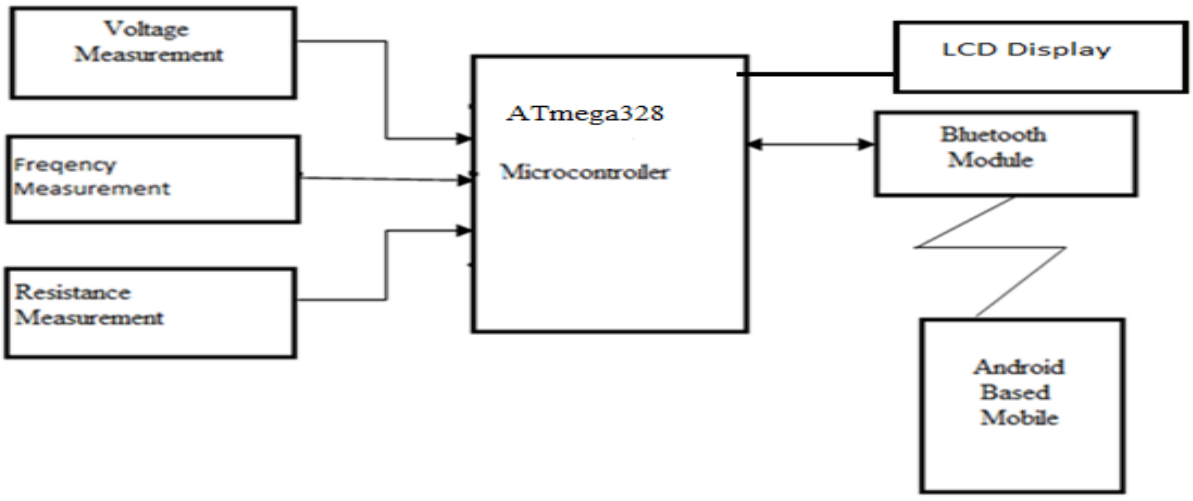


Fig3.1: Block diagram of Android Based Oscilloscope Using Android Mobile

Description of Block Diagram:

i) Microcontroller: In any system controller is the brain of the system. In our case, a Microcontroller would be necessary to sample the input data and process it. Moreover it would also be required to convert the data coming to data which follows UART protocol as majority of the Bluetooth have only UART ports. Therefore we decided that any microcontroller we considered must have the following features:

For our work, we proposed to choose micro controller AVR Atmega 16.Now Following are the reasons of choosing AVR micro-controller. 1. AVR microcontroller is 8-bit on chip system with RISC (Reduced Instruction Set Computer) command system.

2. The most of commands are performed in one clock cycle.

3. In AVR microcontroller reading next command is done during execution of previous command. So the overall number of commands in 1 second is almost equal to working frequency.

4. It differs from other microcontrollers that it requires less power in higher frequencies.

5. AVR microcontroller has 32 general purpose registers.

6. PIC's have one general purpose register so called accumulator.

7. And comparing to similar PI AVR's have more advanced architecture that allows running one instruction per clock cycle while PIC microcontrollers run one instruction in 4 clock cycles.

High Endurance Non-volatile Memory

- 512 Bytes EEPROM
- 1K Byte Internal SRAM and write/Erase Cycles: 10,000 Flash/100,000 EEPROM

Table:3.1 Comparison of various controllers

PARAMETERS	8051	PIC	AVR
ARCHITECTURE	8 Bit based on CISC	8 Bit based on RISC	8 Bit based on RISC
INSTRUCTIONS	250 instructions that takes 1-4 cycles to execute	40 instructions that takes 4 cycles to execute	131 instructions that takes 1cycles to execute
RAM	64K	1K internal SCRAM	68 byte Data RAM
ROM	64K	512 Bytes EEPROM	64 Bytes EEPROM
POWER	Consume more power	Consume less power	Consume less power
SPEED FACTOR	1 million instructions per second	3 million instructions per second	12 million instructions per second
PERIPHIRAL FEATURES	Less Available	SPI,I2C,ADC,ISP ,USART, ISA,etc.	SPI,I2C,ADC,ISP ,USART, ISA,etc.
COST	Low	High	High
PROGRAMMING	Simple	complex	complex

ii) **Bluetooth Connectivity**:-

The Android platform includes support for the Bluetooth network stack, which allows a device to wirelessly exchange data with other Bluetooth devices. The application framework provides access to the Bluetooth functionality through the Android Bluetooth APIs. These APIs let applications Wirelessly connect to other Bluetooth devices, enabling point-to-point and multipoint wireless features. HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4❨

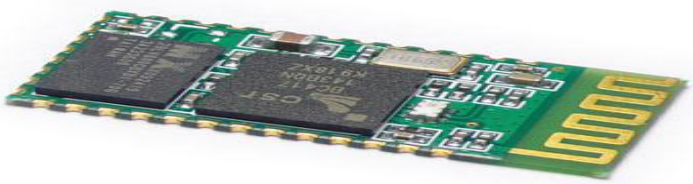
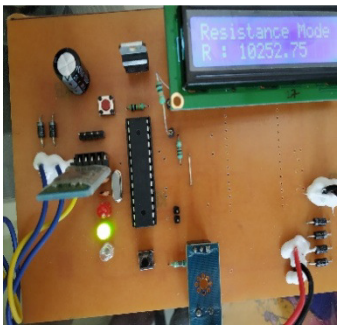
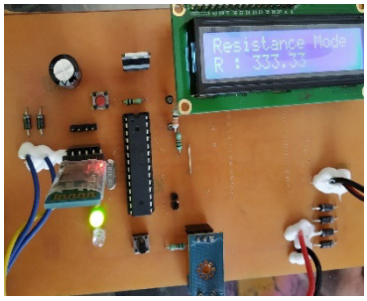


Fig2.Bluetooth Module HC-05

4. Results

Following figure shows the operation of the sysystem.





10kΩ 1kΩ 333.33Ω

Fig.4.1 Resistance Measurement

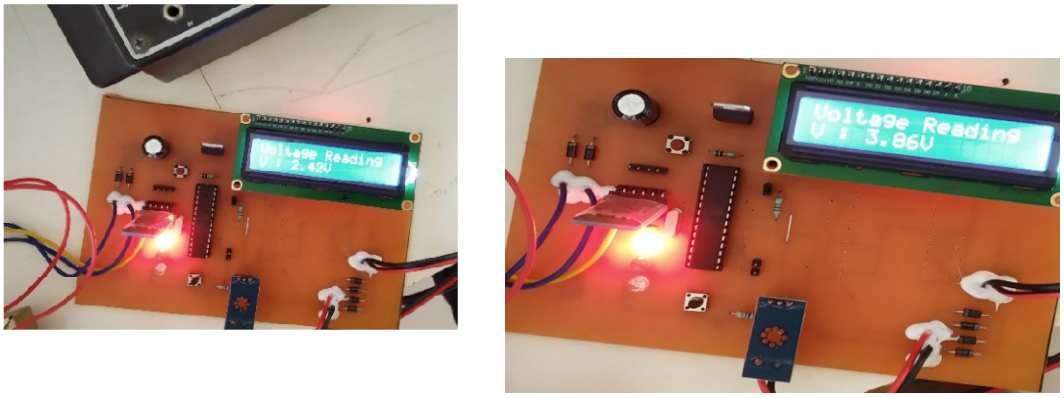


Fig.4.2Voltage Reading

5. Conclusion & Future Scope:

The Android is an emerging technology in mobile platform. Various applications can be created by using Android. In this paper we are actually implementing one of the applications of Android i.e., Oscilloscope. It is nothing but the Bluetooth embedded oscilloscope which sends the data towards android mobile serially and waveform is plotted on display. However, this Oscilloscope until now works only at 1 KHz and 5V, but still further implementation may result into increase its range just like CRO and DSO. We are actually focusing on idea of Oscilloscope on android mobile which is portable, low-cost, less power consumption, low complexity Arduino Android oscilloscope. The software application developed for Android receives the data transferred from the hardware device and plots the waveform according to the display settings which is set by the user.

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